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PROFESSIONAL PAPER 332 / March 1982

AD A113592

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Christopher Jehn

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Marine Corps Operations Analysis Group

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The following is a talk given at a conference on rapid deployment forces sponsored by the American Institute of Aeronautics and Astronautics in Boston, Massachusetts, December 10-11, 1981 and in Washington, D.C., December 14-15, 1981. The author wishes to acknowledge the invaluable assistance of his colleagues at the Center for Naval Analyses, particularly C. Bernard Barfoot and William F. Morgan.



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THE RDF AND AMPHIBIOUS WARFARE

Christopher Jehn



CENTER FOR NAVAL ANALYSES

THE RDF

**A FOUR-SERVICE TASK FORCE
DESIGNED FOR USE IN
SOUTHWEST ASIAN CONTINGENCIES**

What is the Rapid Deployment Joint Task Force (RDJTF)? *q is* First, it's simply a four-service task force designed for use in southwest Asian contingencies. When it was originally conceived, the thought was that it could be used for any non-NATO contingency, but its design and exercise since then has obviously been pointed towards employment in southwest Asia, particularly the Persian Gulf area. A current example is the exercise, Operation Bright Star-82. ~~I'll draw~~ several lessons *are drawn* from that exercise.

RAPID DEPLOYMENT FORCES

- **ARMY AIRBORNE UNITS**
- **OTHER ARMY UNITS**
- **AIR FORCE TACTICAL AVIATION**
- **MARINE AIR-GROUND TASK FORCES**
- **NAVAL FORCES**
- **PREPOSITIONING SHIPS (NTPS/MPS)**

What forces are included? The RDJTF consists of Army airborne units such as the 82nd Airborne Division; other Army units; Air Force tactical aviation; Marine air-ground task forces; other Naval forces such as carrier battle groups; and the so-called prepositioning ships, those associated with the near-term prepositioning program (NTPS) and the maritime prepositioning program (MPS). Also included is the headquarters at MacDill Air Force Base in Tampa.

The NTPS program consists of a number of ships presently stationed at Diego Garcia containing ground combat equipment and supplies for one Marine Brigade, plus some supplies for Army and Air Force units. The maritime prepositioning program, when it is completely implemented, will consist of three sets of ships, each set containing the ground combat equipment and supplies for one Marine brigade. The last MPS set will replace the NTPS ships.

Note that there's really nothing new in the RDJTF except for the headquarters element at MacDill and those prepositioning ships. All the other forces already existed and were simply designated part of the rapid deployment force with operational control over them being given to the Commander of the RDJTF.

USE OF RDF

- **SOUTHWEST ASIA (PERSIAN GULF)**

For what will we use the RDJTF? It's quite clear that it's focused on southwest Asia and, in particular, the Persian Gulf. And, of course, that's no accident. While there had been a growing awareness within the Department of Defense that more rapidly deployable forces were desirable, events in southwest Asia--the fall of the Shah, the Soviet invasion of Afghanistan--really triggered the formation of the RDJTF. As further evidence of the southwest Asian/Persian Gulf focus of the RDJTF, we have the NTPS ships stationed at Diego Garcia in the Indian Ocean.

PERSIAN GULF "SCENARIOS"

- **SUPPORT FRIENDLY REGIME AGAINST
EXTERNAL THREAT**
- **SUPPORT FRIENDLY REGIME AGAINST
INTERNAL THREAT**
- **DIRECT ACTION TO DEFEND U.S. INTERESTS**

In what scenarios or situations might we use the RDJTF? I think there are three. First, we could use it to support a friendly regime against an external threat. In this case, we'd be invited in to protect, say, Egypt against an invasion by Libya, or to strengthen Oman against an invasion or a threat from South Yemen. The second case is where we are asked to support a friendly regime against an internal threat. We might be invited in by the Saudi Arabians, for example, to help them fight guerrillas supported by Iraq or South Yemen, or we might be asked to help Oman fight guerrillas supported by South Yemen. The third case, it seems to me, is direct intervention by the U.S. to protect our interests. For example, we might want to respond to a Soviet invasion of Iran or to the Iranians closing the Strait of Hormuz.

In the first two cases only--that is, where we are invited into a country to support a friendly regime against either an external or internal threat--in both of these cases, but these two cases only, we can reasonably expect support where and when U.S. forces arrive. And only in the first case is it reasonable to expect no one will try to stop us from coming in. And even that will be true only some times.

**LIKELY SCENARIOS IMPLY
NECESSITY FOR**

- **TACTICAL INTEGRITY**
- **FORCIBLE ENTRY**

The implication, I think, is clear. It's best for U.S. forces to arrive with tactical integrity, and they may have to fight their way in. Now in some circumstances airborne troops--those of the 82nd Airborne Division, for example--might suffice, but in most instances, the only safe way to introduce the first U.S. combat forces is amphibiously.

ADVANTAGES OF AMPHIBIOUS FORCES

- **FORCIBLE-ENTRY CAPABILITY**
- **FLEXIBILITY**
 - **POLITICAL**
 - **TACTICAL**
- **COMBAT POWER**
- **CAN USE OTHER NAVAL FORCES**

Amphibious assault forces provide a lot of advantages. First, they provide a forcible entry capability. That's because amphibious assault forces have both tactical integrity and assault capability.

Second, amphibious forces provide a great deal of flexibility-- political and tactical flexibility. Political flexibility arises because amphibious forces can be ready off shore, where they lend presence, signal U.S. intent, and in general permit U.S. posturing, without becoming a liability to a host nation. Many countries might be unwilling to have U.S. forces ready on their territory but would be quite willing to have U.S. amphibious forces nearby. The Omanis' last-minute request to reduce the size of the Marine landing force during Bright Star-82 illustrates this point.

The tactical flexibility that amphibious forces represent is, of course, well known. There are two dimensions to this. First, they can go ashore in many places. That dilutes defenses and allows the projection of force without being tied to a developed port or airfield. But, it's also true that amphibious forces can be withdrawn more easily than can other forces. This dimension is rarely recognized and can be important if, for example, we wish to quickly leave a country where we may become a political liability. Amphibious forces can also be more easily moved to another theater or another objective area in the same theater after the Marines have disembarked. I am not suggesting here that current planning either does or should call for amphibious shipping to remain in theater. What I am suggesting is that amphibious forces can provide withdrawal and mobility options that other forces do not provide.

Another advantage of amphibious forces is their combat power. Battalion for battalion, there's more firepower in amphibious forces than in U.S. airborne forces. And maximizing the firepower per combat soldier is important, because neither amphibious forces nor airborne forces can match the firepower of mechanized or armored forces, and, as we'll soon see, getting more troops to the objective area is a problem.

A final, but hardly insignificant, advantage of amphibious forces is that they are well equipped to use the naval power that accompanies them. Tactical aviation--both Marine and Navy tactical air--comes most immediately to mind. But the Marine Corps trains with the Navy and can exploit naval power whether it's guns, missiles, or tactical air. This ability to use naval power is important because of the low organic firepower of highly mobile forces, whether they're airborne or amphibious. Again, Bright Star-82 provides a useful illustration. As part of the maneuvers in Egypt, Air Force B-52s flew non-stop, with in-flight refueling, to Egypt and there dropped a 13,000-pound payload of bombs from each plane. Spectators were apparently impressed, but I think there has rarely been a better demonstration of the value of sea-based tactical aviation. Navy or Marine A-6s flying off a carrier in

ADVANTAGES OF AMPHIBIOUS FORCES

- **FORCIBLE-ENTRY CAPABILITY**
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- **CAN USE OTHER NAVAL FORCES**

the Eastern Mediterranean can carry the same payload, and don't need to fly half way around the world to reach their target.

Now, it has been fashionable, from time to time throughout the post-World War II period, to point out the disadvantages or vulnerabilities of amphibious warfare. I am well aware of those problems, but they are beside the point here--which is why I haven't addressed them. It's important to ask, "Compared to what?" Our amphibious forces are the only credible way we have to forcibly enter another country.

IF RDF WERE FREE

- **AMPHIBIOUS FORCES**
- **SOME AIRBORNE FORCES**

BUT HIGH COSTS LEAD TO

- **TODAY'S RDF**

If the rapid deployment forces were free, if costs were no object, I think a rapid deployment force should consist entirely of amphibious forces, with some airborne units for really fast response. But, of course, cost is an object. Amphibious forces are very expensive. And so are airborne forces, especially if you count their airlift, as we count sealift for amphibious forces. Hence, we have today's RDJTF--a large force that is not nearly as expensive as either airborne or amphibious forces of the same size. But, there's a catch.

TODAY'S RDF DEPENDS ON

- **CREATING A "BENIGN" ENVIRONMENT**
- **AIRLIFT**

Today's rapid deployment force is, in my judgement, too often viewed as a way to get something for nothing, or perhaps more charitably, something for very little. But, of course, that's impossible. In effect, to lower the costs of conventional rapidly deployable forces, we have relied very heavily on a benign environment, and airlift. Let's look at these two points more closely.

"BENIGN" ENVIRONMENT MEANS

- **GOOD PORT/AIRFIELD COMBINATION**
- **SECURITY**

What do I mean by a benign environment? I've given you a hint already. Most RDJTF forces, all but the amphibious forces and the airborne forces, go by sea and air combination--the equipment going mostly by sea, troops and some equipment by air. Now this requires a good, secure port and airfield close together, and a secure environment for the marry-up of the airborne and seaborne elements. How "good" is necessary? Well, let me ask you to use your imagination here. Picture a brigade or division's worth of ground combat equipment arriving by sea and, say, 15,000 troops arriving by air. The troops need to find their equipment--their tanks, their vehicles, their supplies, their heavy weapons--and then marshal in an area so that they're ready for subsequent combat operations. This implies that the port and airfield must be well-developed as well as close together, and have lots of room available for the forces to marry up. There are some such sites in the Persian Gulf area, but they may be in the wrong places.

How secure do the facilities have to be? Well, obviously that's scenario-dependent. But again, let me ask you to use your imagination. Remember, the units are arriving without tactical integrity. The troops aren't ready for combat and can be almost as vulnerable as civilians. The transport aircraft would be easy targets for the most unsophisticated antiair weapons, such as shoulder-fired heat-seeking missiles like the Soviet-made SA-7. That implies that a very small number--perhaps as few as 50--terrorists or guerrillas could seriously disrupt things. So that means we need a security force first, and perhaps quite a large one. I'd argue that in many cases as much as a regiment would be necessary--perhaps more--along with associated support.

**HYPOTHETICAL AIRLIFT
(50,000 PEOPLE)**

- **140 B-747 SORTIES REQUIRED**
- **AIRCRAFT AVAILABLE**
 - **CRAF: 60 B-747 EQUIVALENTS**
 - **MAC: 60 B-747 EQUIVALENTS**

Now let's turn to airlift. Again, let me ask you to use your imagination and picture how hard it's going to be to move the RDJTF. As an example, consider moving only about 50,000 troops. Now 50,000 troops represent about a Marine Corps division and air wing, and their combat service support. To move 50,000 people from mid-CONUS to the Persian Gulf would require about 140 B-747 sorties. Where will those planes come from? There are two sources. One is the civil reserve air fleet (or CRAF). It has about 60 B-747 equivalents that could be called on without full mobilization. Now obviously, taking 60 B-747 equivalents out of the civil air fleet would seriously affect civil aviation. Further, I've made some generous assumptions here, including one that all cargo aircraft in CRAF can be converted to passenger service. That's almost surely wrong. The second source of aircraft is the Military Airlift Command. MAC, too, has about 60 B-747 equivalents, not counting the C-5s which would be used for carrying outsize equipment such as air defense gear, some ground combat equipment, and helicopters. Taking 60 B-747 equivalents out of MAC would end all other MAC missions such as resupply to other deployed forces. Bright Star-82 is illustrative here, too. There we moved only about 4,000 troops by air, but, if we are to believe newspaper accounts, that small demand seriously disrupted MAC's other functions. And I still haven't talked at all about how RDJTF cargo would be moved by air.

OTHER AIRLIFT PROBLEMS

- **FUEL**
- **OVERFLIGHT AND LANDING RIGHTS**

But that's really only the beginning as far as airlift is concerned. Finding the planes may be the easiest part of the problem. First, consider fuel. A B-747 round trip from CONUS to the Persian Gulf uses about 450 tons of fuel. To give you some perspective, a typical railroad tank car holds about 35 tons. Thus we need over 10 tank cars of fuel for every sortie to the Persian Gulf. So, that good port and airfield combination needs an adjacent tank farm, and refueling spots along the way must have fuel too. Obviously, gaining overflight rights and landing rights at maintenance and refueling sites is also important. If this seems an exaggeration, recall that in 1973, when we began an airlift to support Israel, of all our so-called allies and friends only one--Portugal--was willing to let us use her bases for the resupply of Israel. And, I haven't even talked at all about moving cargo by air to the Persian Gulf.

**OTHER RDF UNITS COMPLEMENT
AMPHIBIOUS FORCES BY PROVIDING**

- **RAPID REINFORCEMENT**
- **FOLLOW-ON RESUPPLY SHIPPING**

Now, all of this suggests--I think quite conclusively--that the Rapid Deployment Joint Task Force is not a substitute for our conventional rapidly deployable forces--the United States Marine Corps and Army airborne units. Thus, the RDJTF is not a substitute for amphibious assault capability; but I believe it is a complement.

**AMPHIBIOUS FORCES COMPLEMENT OTHER
RDF UNITS BY PROVIDING:**

- **SECURITY FOR OFFLOADING FACILITIES**
- **GROUND TRANSPORTATION AND SHIP-TO-SHORE
SYSTEMS**
- **SOME MEDICAL FACILITIES**
- **ENHANCED C³**

Obviously, other RDJTF units complement the amphibious forces by providing a capability for rapid reinforcement and, in the form of those prepositioned ships and their supplies, a source of resupplies and follow-on resupply shipping. By the same token, it's clear that amphibious forces complement the other RDJTF units. Indeed, they are a necessary prerequisite for the use of other RDJTF forces in most scenarios. The amphibious forces, as I've already argued, are necessary to create the benign environment which is essential for the introduction of other RDJTF units. They can also provide ship-to-shore systems for offloading in the absence of ports, and ground transportation to assist in the marry-up of troops and equipment. Amphibious ships have medical facilities, and that's important because U.S. military medical facilities are in short supply no matter where you look. Finally, amphibious ships, particularly the LHAs, can provide a great deal of command and control capability that might not otherwise be in theater.

SOME OTHER RDF PROBLEMS

- **SERVICE INTERFACE**
- **MEDICAL CAPABILITY**
- **SUSTAINABILITY**

In short, other RDJTF forces strengthen or reinforce our amphibious assault capability, while amphibious forces are an absolutely essential part of the RDJTF in most scenarios. Even with amphibious forces I think there still are some very serious problems with the RDJTF.

The first of these is what might be called the problem of service interfaces or tactical, doctrinal or equipment mismatches. The Navy/Marine Corps team and the Air Force/Army team each practice, but they do not often practice with one another. That is, Navy/Marine Corps teams have not practiced very much with Army/Air Force teams, and the current RDJTF is exercising and planning to correct this. But practice cannot solve problems of equipment interface. The most notable are air control and air defense systems, and the automated systems that will control fire support in the Army and Marine Corps.

Another important problem with the RDJTF, indeed a problem with all our forces regardless of where and how we deploy them, is a shortage of medical facilities. In some circumstances there could also be a shortage of medical personnel, particularly physician specialists like surgeons and anesthesiologists.

Finally, and perhaps most important, is the problem of sustainability. The problem here is quite obvious--in essence, I've already discussed it. We're talking about very great distances when we talk about deploying to the Persian Gulf, and when great distances are involved, sustainability is always a problem. Getting spare parts, resupplies, and more equipment to deployed forces so they can keep fighting effectively will always be difficult. It's perhaps a bigger problem than it need be because of the lack of over-the-beach capabilities. That is, presently, resupply shipping must go, as the RDJTF forces themselves must, through improved ports. So development of improved, over-the-beach capabilities is obviously an imperative, I think, for improving the capability of the RDJTF. It's also, I think, an imperative if we are to improve our amphibious forces and our ability to project force quickly and support extensive combat power at great distances.

CONCLUSIONS

- **MARINES WILL BE "FIRST TO FIGHT"**
- **TODAY'S RDF HAS SOME SERIOUS PROBLEMS**
 - **RELIANCE ON AIRLIFT**
 - **SUSTAINABILITY**
 - **MEDICAL CAPABILITIES**
- **SOLUTIONS ARE POSSIBLE**

What does all this mean as far as amphibious forces and the RDJTF are concerned? When our host asked me to speak, I thought doing so would be quite easy. But I've discovered it wasn't so easy, and for a curious reason: I have a very simple message, and it's often hardest to deliver a simple message in a convincing way. I hope I've succeeded. In any case, my message is that amphibians almost surely ought to be the first to go in because they deliver forces with the tactical integrity and forcible entry capability that is so essential to creating the benign environment that the rest of the RDJTF requires. That is, a rapid deployment force without amphibious forces is simply not credible, at least not in the scenarios we have recently been considering. But, and some may find this ironic, the RDJTF has made amphibious assault more credible--because it provides explicit designation of forces and plans to reinforce and justify an amphibious assault. So once again, I think, we'll find the Marines may well be the first to fight*.

Another message is that today's RDJTF has some very serious deficiencies: excessive--perhaps unsafe--reliance on airlift, sustainability problems, and medical problems. But solutions are possible.

What needs to be done? Obviously, there are technical solutions to some of the problems I've described. Notable examples include logistical equipment to improve our over-the-shore resupply capability, in-theater POL and water distribution systems, and more lightweight firepower for infantry. Also, there are cures to the doctrinal and tactical problems of the RDJTF. The RDJTF Headquarters is hard at work on those problems. Exercises, such as the recent Bright Star, and planning will go a long way, indeed have already gone a long way, to curing some of those problems.

Also, there are cures to some of the problems I've cited that might be called force deployment or force level solutions. A very good way to ensure that it's more likely we'll have amphibious forces in theater when they're needed is to alter the present very predictable pattern of small, battalion-size deployments of Marines aboard amphibious ships, for larger and perhaps more random deployments of brigade size. That won't necessarily be easy, though. For example, brigade-size deployments would be harder to support within the Marine Corps' current

* This paragraph, indeed this entire talk, may seem to ignore the capabilities of airborne forces. I do not intend to imply that airborne forces are not useful to the RDJTF. Nonetheless, they are clearly less flexible than amphibious forces (though, obviously, they can land in some places amphibious forces cannot) and, because of our limited airlift, they cannot respond as quickly in large numbers. However, more useful than quibbling over the relative merits of airborne and amphibious forces would be analysis of how they could be used together. I have not tried to do that here.

CONCLUSIONS

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 - **RELIANCE ON AIRLIFT**
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size and structure. Among other things, more amphibious lift would also help, and the current administration is talking as if it's going to buy more. More airlift would also help.

Regardless of solutions, the RDJTF, and its problems, have demonstrated an old saw: there's no such thing as a free lunch. Projecting power to the other side of the earth isn't easy, or cheap. What I hope I've done is stimulate you to think about ways to make power projection and the protection of United States interests at long distance easier, more effective, and cheaper.

CMA PROFESSIONAL PAPERS - 1978 TO PRESENT*

- PP 211
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- PP 214
Weinland, Robert G., "A Somewhat Different View of The Optimal Naval Posture," 37 pp., Jun 1978 (Presented at the 1976 Convention of the American Political Science Association (APSA)/US Panel on "Changing Strategic Requirements and Military Posture"), Chicago, Ill., September 2, 1976), AD A056 228
- PP 215
Colle, Russell C., "Comments on: Principles of Information Retrieval by Manfred Kochen," 10 pp., Mar 78 (Published as a Letter to the Editor, Journal of Documentation, vol. 31, No. 4, pages 298-301), December 1975), AD A054 426
- PP 216
Colle, Russell C., "Lotka's Frequency Distribution of Scientific Productivity," 18 pp., Feb 1978 (Published in the Journal of the American Society for Information Science, vol. 28, No. 6, pp. 366-370, November 1977), AD A054 425
- PP 217
Colle, Russell C., "Bibliometric Studies of Scientific Productivity," 17 pp., Mar 78 (Presented at the Annual meeting of the American Society for Information Science held in San Francisco, California, October 1976), AD A054 442
- PP 218 - Classified
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Huntzinger, R. LeVar, "Market Analysis with Rational Expectations: Theory and Estimation," 60 pp., Apr 78, AD A054 422
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Maurer, Donald E., "Diagonalization by Group Matrices," 26 pp., Apr 78, AD A054 443
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Weinland, Robert G., "Superpower Naval Diplomacy in the October 1973 Arab-Israeli War," 76 pp., Jun 1978 (Published in Seapower in the Mediterranean: Political Utility and Military Constraints, The Washington Papers No. 61, Beverly Hills and London: Sage Publications, 1979) AD A055 564
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*Portions of this work were started at the Institute of Applied Mathematics and Statistics, University of British Columbia, Vancouver, B.C., Canada
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*Portions of this work were completed at the Institute of Applied Mathematics and Statistics, University of British Columbia, Vancouver, Canada.
- PP 226
Reiston, J. M. and J. K. Mann, "Temperature and Current Dependence of Degradation in Red-Emitting GaP LEDs," 34 pp., Jun 1978 (Published in Journal of Applied Physics, 50, 3630, May 1979) AD A058 538
*Bell Telephone Laboratories, Inc.
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Mangel, Marc, "Diffusion Theory of Reaction Rates, I: Formulation and Einstein-Smoluchowski Approximation," 50 pp., Jan 1978, AD A058 541
- PP 230
Mangel, Marc, "Diffusion Theory of Reaction Rates, II Ornstein-Uhlenbeck Approximation," 34 pp., Feb 1978, AD A058 542
- PP 231
Wilson, Desmond P., Jr., "Naval Projection Forces: The Case for a Responsive MAF," Aug 1978, AD A054 543
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- PP 234 - Revised
Jondrow, James and Levy, Robert A., "Does Federal Expenditure Displace State and Local Expenditure: The Case of Construction Grants," 25 pp., Oct 1979, AD A061 529
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Mizrahi, Maurice M., "The Semiclassical Expansion of the Anharmonic Oscillator Propagator," 41 pp., Oct 1978 (Published in Journal of Mathematical Physics 20 (1979) pp. 844-855), AD A061 538
- PP 237
Maurer, Donald, "A Matrix Criterion for Normal Integral Bases," 10 pp., Jan 1979 (Published in the Illinois Journal of Mathematics, vol. 22 (1978), pp. 672-681)
- PP 238
Jorgoff, Kathleen Classen, "Unemployment Insurance and The Employment Rate," 20 pp., Oct 1978 (Presented at the Conference on Economic Indicators and Performance: The Current Dilemma Facing Government and Business Leaders, presented by Indiana University Graduate School of Business), AD A061 521
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Trost, R. P. and Werner, J. T., "The Effects of Military Occupational Training on Civilian Earnings: An Income Selectivity Approach," 38 pp., Nov 1979k, AD A077 831
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Powers, Bruce, "Goals of the Center for Naval Analyses," 13 pp., Dec 1978, AD A063 759
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Simpson, William R., "The Analysis of Dynamically Interactive Systems (Air Combat by the Numbers)," 160 pp., Dec 1978, AD A063 760
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Simpson, William R., "A Probabilistic Formulation of Murphy Dynamics as Applied to the Analysis of Operational Research Problems," 18 pp., Dec 1978, AD A063 761
- PP 244
Sherman, Allen and Horowitz, Stanley A., "Maintenance Costs of Complex Equipment," 20 pp., Dec 1978 (Published By The American Society of Naval Engineers, Naval Engineers Journal, Vol. 91, No. 6, Dec 1979) AD A071 473
- PP 245
Simpson, William R., "The Accelerometer Methods of Obtaining Aircraft Performance from Flight Test Data (Dynamic Performance Testing)," 403 pp., Jun 1979, AD A075 226
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Brechling, Frank, "Layoffs and Unemployment Insurance," 35 pp., Feb 1979 (Presented at the Nber Conference on "Low Income Labor Markets," Chicago, Jun 1978), AD A096 629
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Nunn, Walter R., "Position Finding with Prior Knowledge of Covariance Parameters," 5 pp., Jun 1979 (Published in: IEEE Transactions on Aerospace and Electronic Systems, Vol. AES-15, No. 3, Mar 1979)
- PP 253
Glasser, Kenneth S., "The d-Choice Secretary Problem," 32 pp., Jun 1979, AD A075 025
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- PP 255 - Classified, AD 5051 441
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Mangel, Marc S. and Thomas, James A., Jr., "Analytical Methods in Search Theory," 86 pp., Nov 1979, AD A077 832
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